

Notice of Allowability

Application No.

10/679,454

Applicant(s)

KATO, YOSHIAKI

Examiner

Zia R. Hashmi

Art Unit

2881

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☒ This communication is responsive to 10/7/2003.
 2. ☒ The allowed claim(s) is/are 20-28.
 3. ☒ The drawings filed on 07 October 2003 are accepted by the Examiner.
 4. ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
 - a) ☒ All b) ☐ Some* c) ☐ None of the:
 1. ☒ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).
- * Certified copies not received: _____.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.

THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.

5. ☐ A SUBSTITUTE OATH OR DECLARATION must be submitted. Note the attached EXAMINER'S AMENDMENT or NOTICE OF INFORMAL PATENT APPLICATION (PTO-152) which gives reason(s) why the oath or declaration is deficient.
 6. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
 - (a) ☐ including changes required by the Notice of Draftsperson's Patent Drawing Review (PTO-948) attached
 - 1) ☐ hereto or 2) ☐ to Paper No./Mail Date _____.
 - (b) ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date _____.
- Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).
7. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

- | | |
|---|--|
| 1. <input type="checkbox"/> Notice of References Cited (PTO-892) | 5. <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 2. <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 6. <input type="checkbox"/> Interview Summary (PTO-413),
Paper No./Mail Date _____. |
| 3. <input checked="" type="checkbox"/> Information Disclosure Statements (PTO-1449 or PTO/SB/08),
Paper No./Mail Date <u>10/7/03</u> | 7. <input type="checkbox"/> Examiner's Amendment/Comment |
| 4. <input type="checkbox"/> Examiner's Comment Regarding Requirement for Deposit
of Biological Material | 8. <input checked="" type="checkbox"/> Examiner's Statement of Reasons for Allowance |
| | 9. <input type="checkbox"/> Other _____. |

DETAILED ACTION

Allowable Subject Matter

1. In accordance with the "Preliminary Amendment", claims 1-19 have been canceled.
2. Claims 20-28 are allowed.
3. The following is an examiner's statement of reasons for allowance:

With respect to independent claims 20, 21, and 23, prior art fails to disclose a mass spectrometer (MS) comprising a first ions source for ionizing sample, and a second ion source producing ions of a polarity reversed from that one of the ions produced by the first ion source; an ion deflector for introducing and deflecting ions from the first and second ion sources; an ion-trap mass spectrometer with a ring and end cap electrodes; a detector for detecting ions from first and second ion sources introduced through the ion deflector into the ion-trap MS; a third ion source for ionizing the sample to be measured; a fourth ion source producing ions of a polarity reversed from that of the third ion source; and a second ion deflector arranged between the ion-trap mass spectrometer and the detector.

In the prior art, one of the difficulties encountered in analyzing the mass spectrum of product ions complicated by multiply-charged ions resulting in high m/z ions is that they can be subjected to mass spectrometry like a single-charged ions. As an example, in mass spectrometry of proteins and DNAs, a protein having a mass of 30,000 gives multiply-charged ions of 30 valences, has an m/z of 1,000, which can be

subjected as single-charged ions having the mass of 1,000. Most proteins and peptides give positive multiply-charged ions, and the DNAs give negative multiply-charged ions. However, these multiple charges can be reduced by ion/ion reactions, which makes it possible to discriminate the multiply-charged ions of a large mass from the chemical noises (caused by impurities) of a low mass region. Moreover, the MS to which the ion/ion reactions are applied in the prior art is only an ion-storage type mass spectrometer, i.e. the ion-trap mass spectrometer. The small-sized mass spectrometer such as the ion-trap mass spectrometer has a limited mass range to be measured, so that the biological high mass molecules such as protein or DNA, can be measured only because they are multiply-charged ions. If the ion/ion reactions are utilized to eliminate the superposition of the mass spectrum over the chemical noises, the biological high molecules go out of measuring range so that they cannot be measured.

The present invention has been conceived to solve such problems and has an object to provide a mass spectrometer system capable of easily improving the efficiency of a charge reduction due to ion/ion reactions and applying the ion/ion reactions even when used with a variety of mass spectrometers. The present invention provides a mass spectrometer system of the components described above, and is characterized in that the ions from the first and second ion sources are mixed between the first and second ion sources, and then introduced together into the mass spectrometer. There is further provided a mass spectrometer system for mass spectrometry of a sample to be measured by ionizing the sample, comprising: a first ion source for ionizing the sample; a second ion source for producing ions of a polarity reversed from that of the ions

produced in the first ion source; a quadrupole mass spectrometer for the mass spectrometry of the ions coming from the first ion source; an rf multipole ion guide for producing product ions of the ions ejected from the quadrupole mass spectrometer; an ion deflector for introducing and deflecting the ions coming from the rf multipole ion guide and the second ion source; a mass spectrometer for the mass spectrometry of the ions ejected from the ion deflector; and a detector for detecting the ions ejected from the mass spectrometer. The mass spectrometer system is characterized in that the ions from the first ion source and the ions from the second ion source are caused to collide in said rf multipole ion guide.

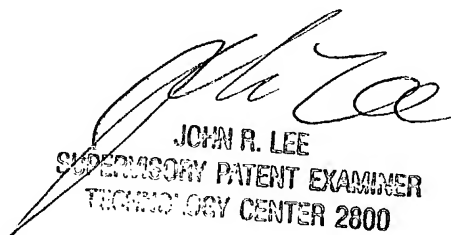
Claims 22 and 24-28 are allowed by virtue of their dependencies on the independent claims 20, 21 and 23.

Conclusion

4. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Zia Hashmi whose telephone number is (571) 272-2473. The examiner can normally be reached between 8.30 AM- 5 PM. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, John R. Lee can be reached on (571) 272-2477.

Zia Hashmi

April 3, 2004.


JOHN R. LEE
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 2800